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ABSTRACT

The world is faced with a variety of environmental problems. No country has escaped pollution and resource depletion. Basic ecological principles are often ignored and sometimes this contributes to ecological disasters. This volume is designed to provide basic information about the quality of the earth's energy resources. The visual aids, worksheets, and activity pages are designed to promote investigative and inquiry experiences, and to foster the use of critical thinking skills through the analysis of environmental problems and solutions. An additional feature is the inclusion of a take-home activity. The activity may be done with simple materials or by conducting a survey. The teaching guide provides suggestions for discussion questions to initiate class participation. Extension activities are also suggested. A research activity that can be used to challenge students and an interdisciplinary activity are also provided. This guide contains 12 reproducible hand-outs, a teaching guide, and four overhead transparencies. Topics include solar energy, wind energy, geothermal energy, hydroelectric power, fossil fuels, energy from plants, nuclear energy, environmental problems, and home energy conservation. A review quiz is also included. (CW)

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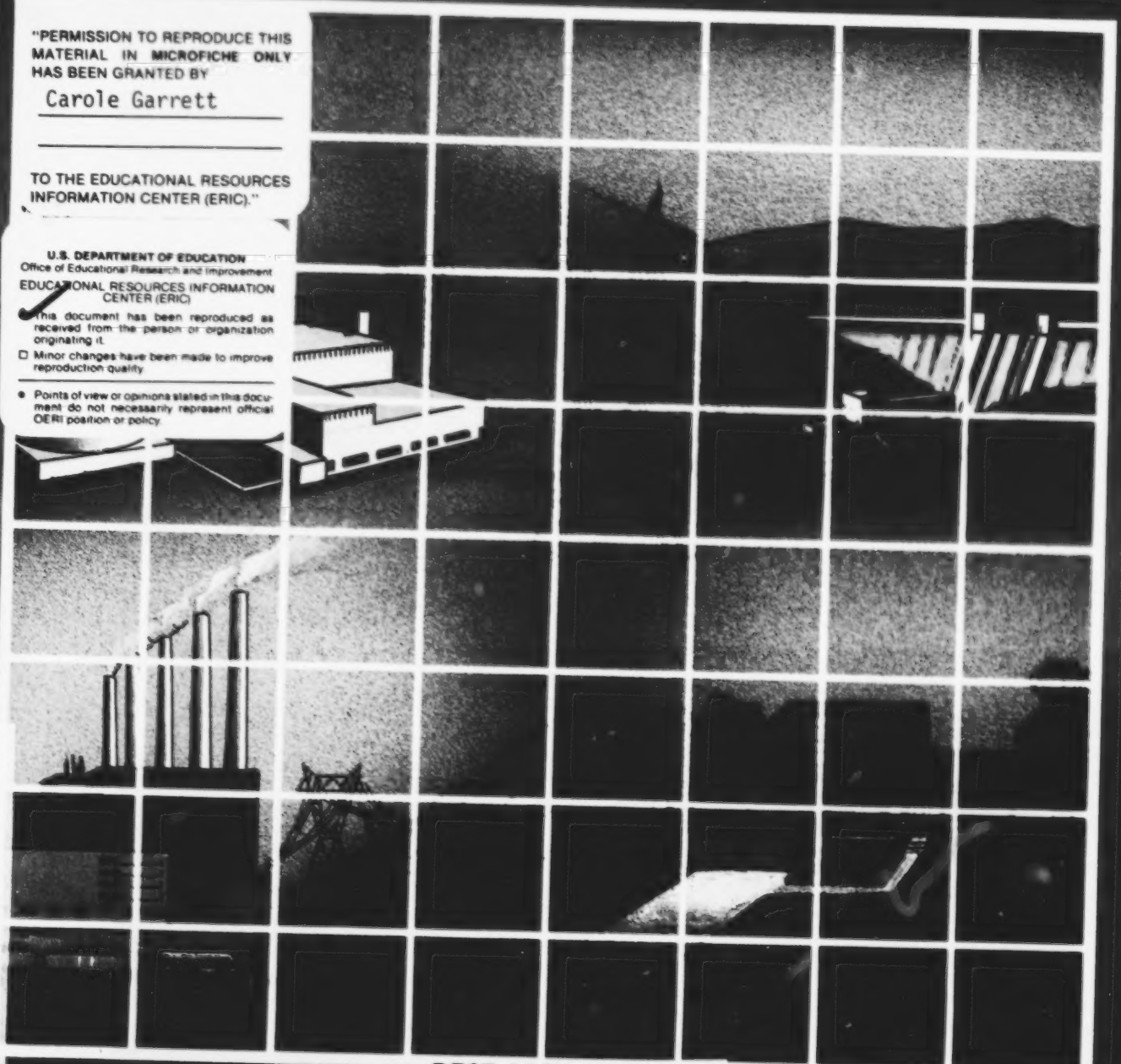

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ENERGY AND THE ENVIRONMENT

The world today is faced with a variety of environmental problems. No country in the world has escaped pollution and resource depletion. Basic ecological principles are often ignored and bring about environmental disasters.

This environmental series is designed to assist teachers in developing among their students an awareness of ecological principles and basic concepts of environmental science. The visual aids, worksheets, and activity pages foster investigative and inquiry experiences. The use of critical thinking skills is encouraged as students are guided to analyze problems and suggest solutions.

An additional feature is the inclusion of a take-home activity. The activity is designed to be done with simple materials or by conducting a survey. This will provide an opportunity for parent involvement in the environmental studies.

The teaching guide provides suggestions for discussion questions to initiate class participation in the study of environmental issues. Extension activities are also provided. The research activity can be used to challenge students and the interdisciplinary activity integrates environmental science with other subjects.

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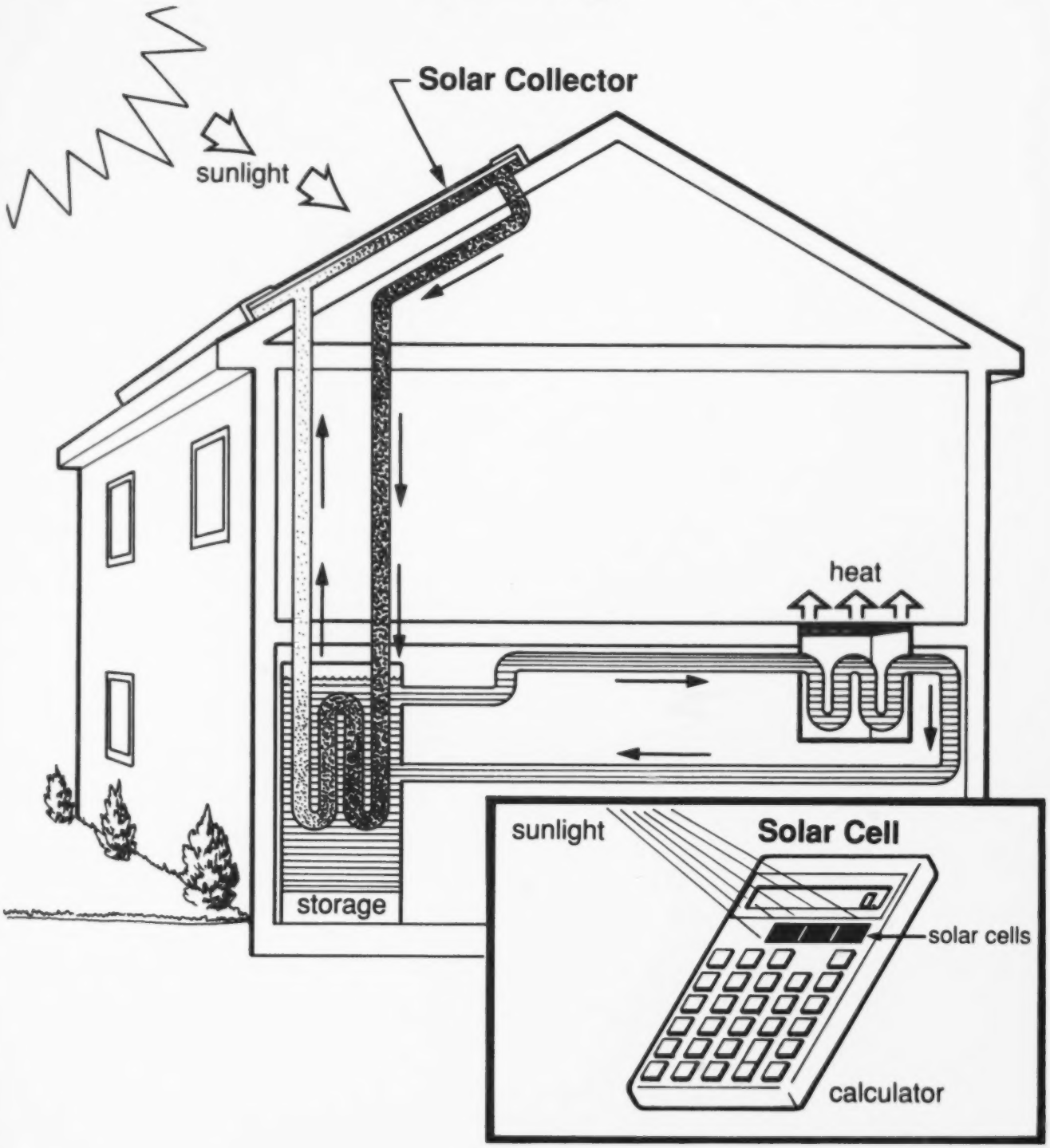
Solar Energy



1. What is the source of solar energy?

2. What are two devices that use solar energy?

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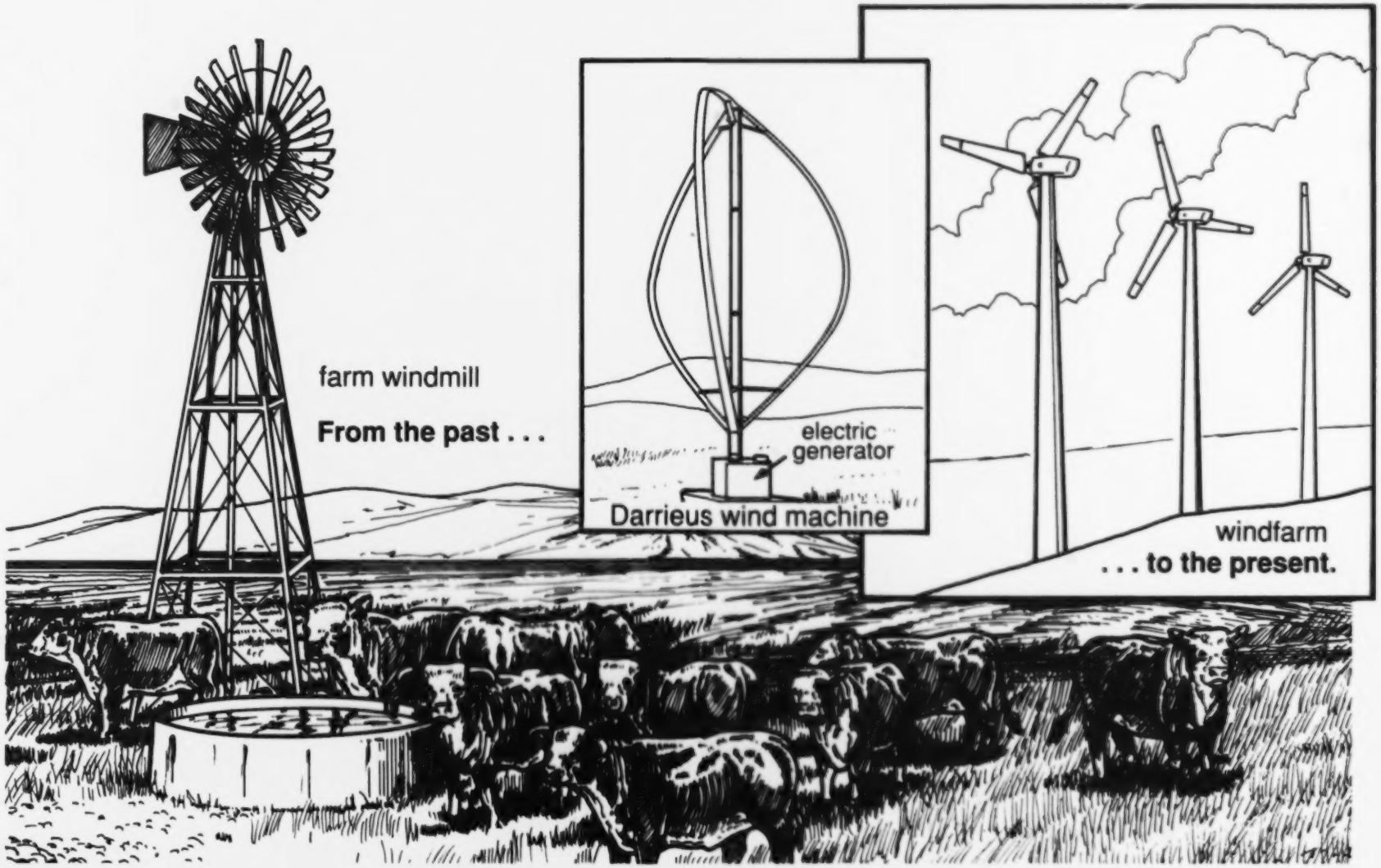
Wind Energy



Q

1. Where was wind energy used in the past?

2. How do present-day wind machines use wind energy?

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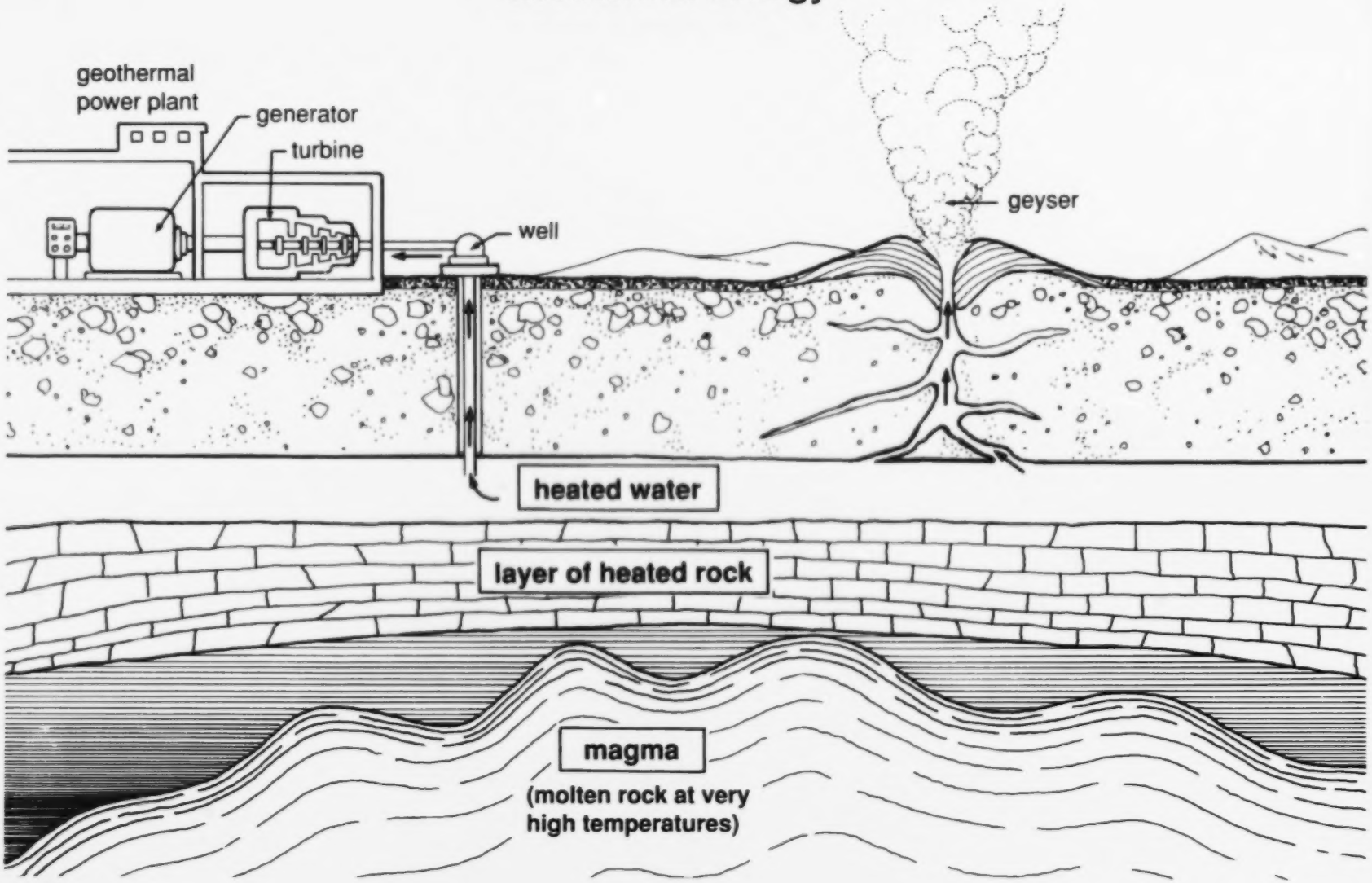
Geothermal Energy



Q

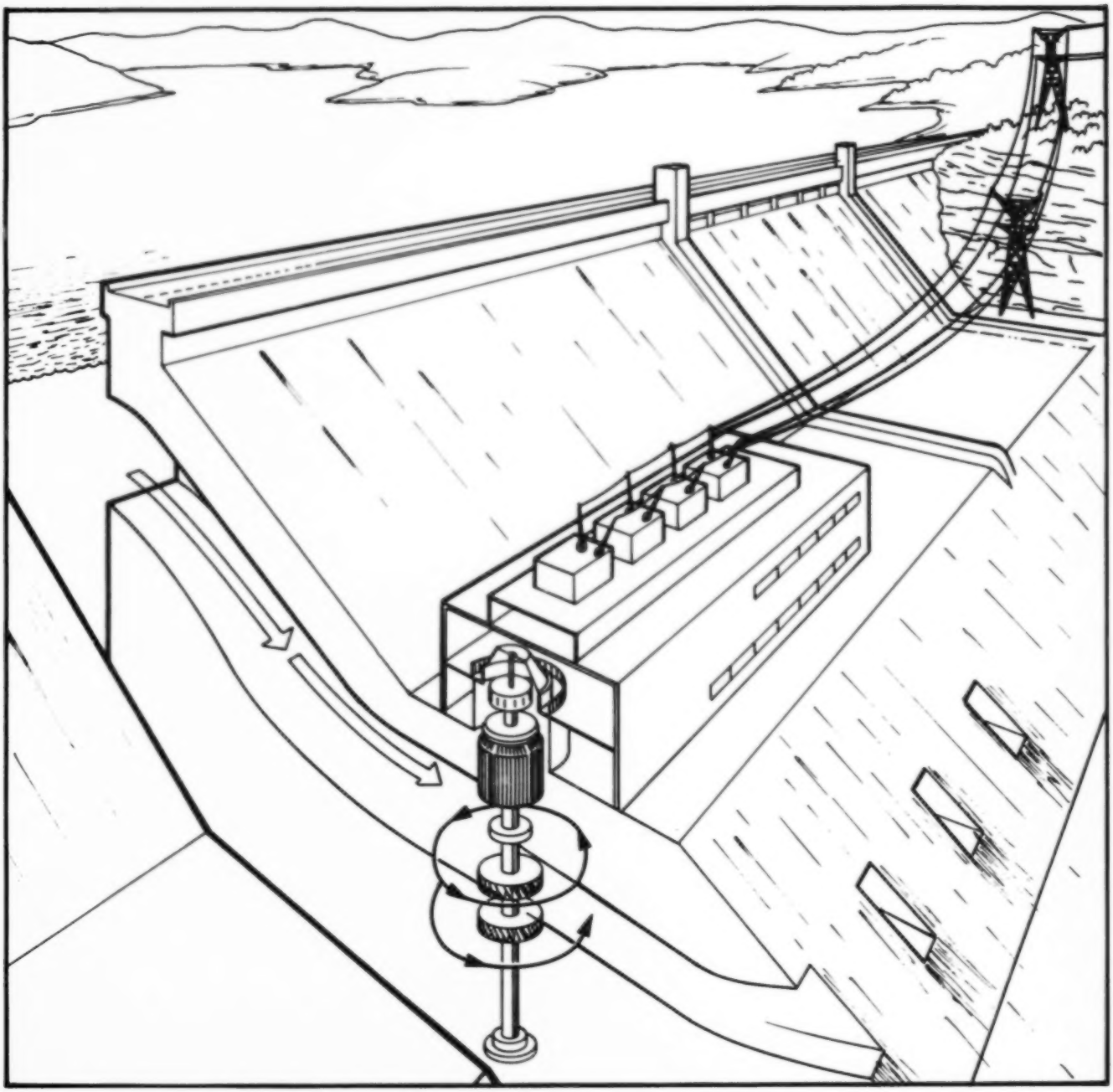
1. What is the source of heat in geothermal energy?

2. What resource is heated underground and brought to the surface at the power plant?

7

8

Energy from Water



Falling water turns machines to make electricity.

Q

1. Is this a good energy source to make electricity? Give your reasons.

2. Is this method of getting electrical energy used in your area? Why or why not?

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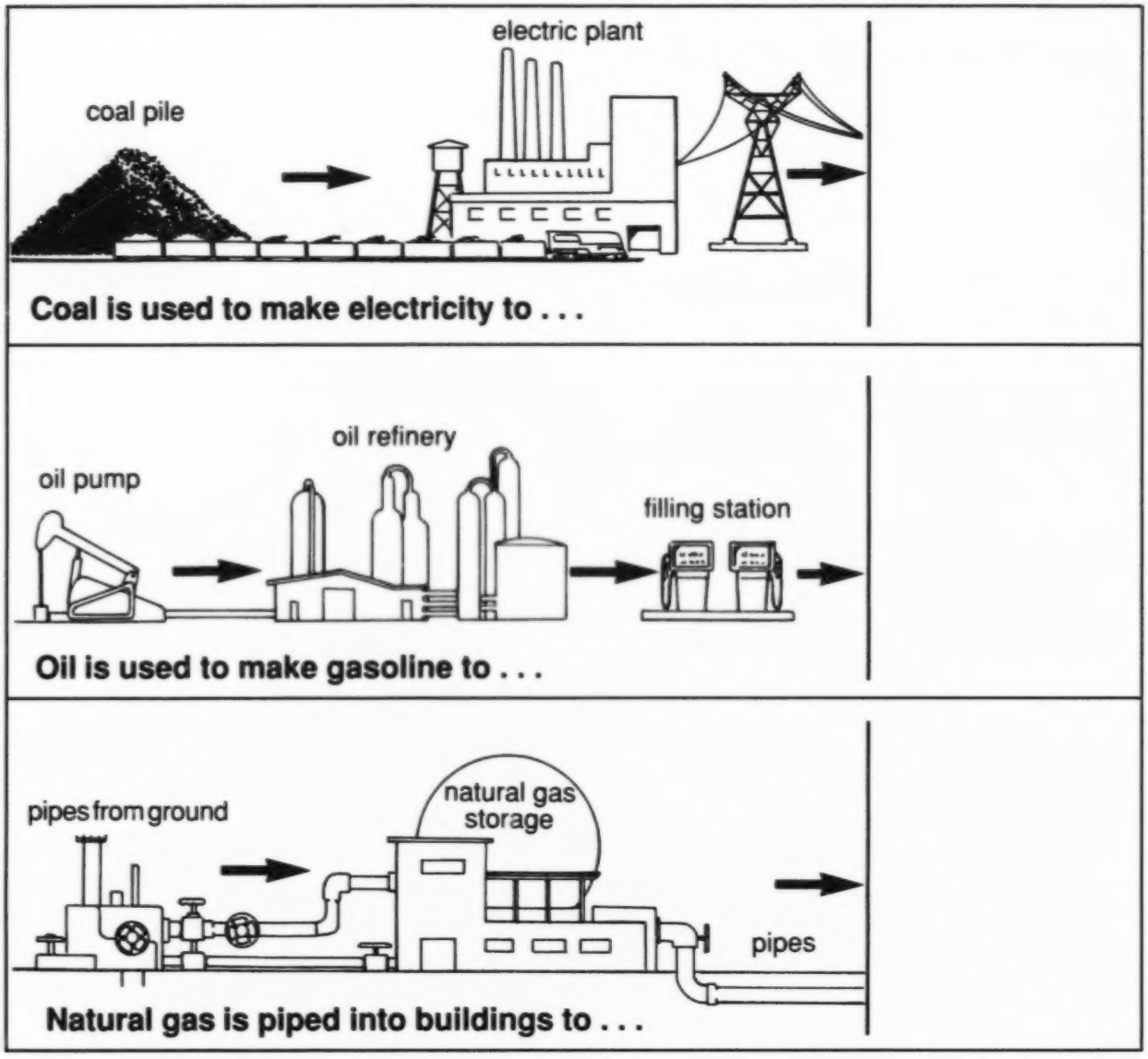
Energy from Fossil Fuels

Fossil fuels are nonrenewable energy resources. When they are gone, there will be no more.


electric plant
coal pile
Coal is used to make electricity to . . .
oil refinery
oil pump
filling station
Oil is used to make gasoline to . . .
pipes from ground
natural gas storage
pipes
Natural gas is piped into buildings to . . .

We need to limit our use of these resources.

1. What are three ways you can limit your use of these fossil fuels?
2. What do you think will happen when we use up all of these fossil fuels?

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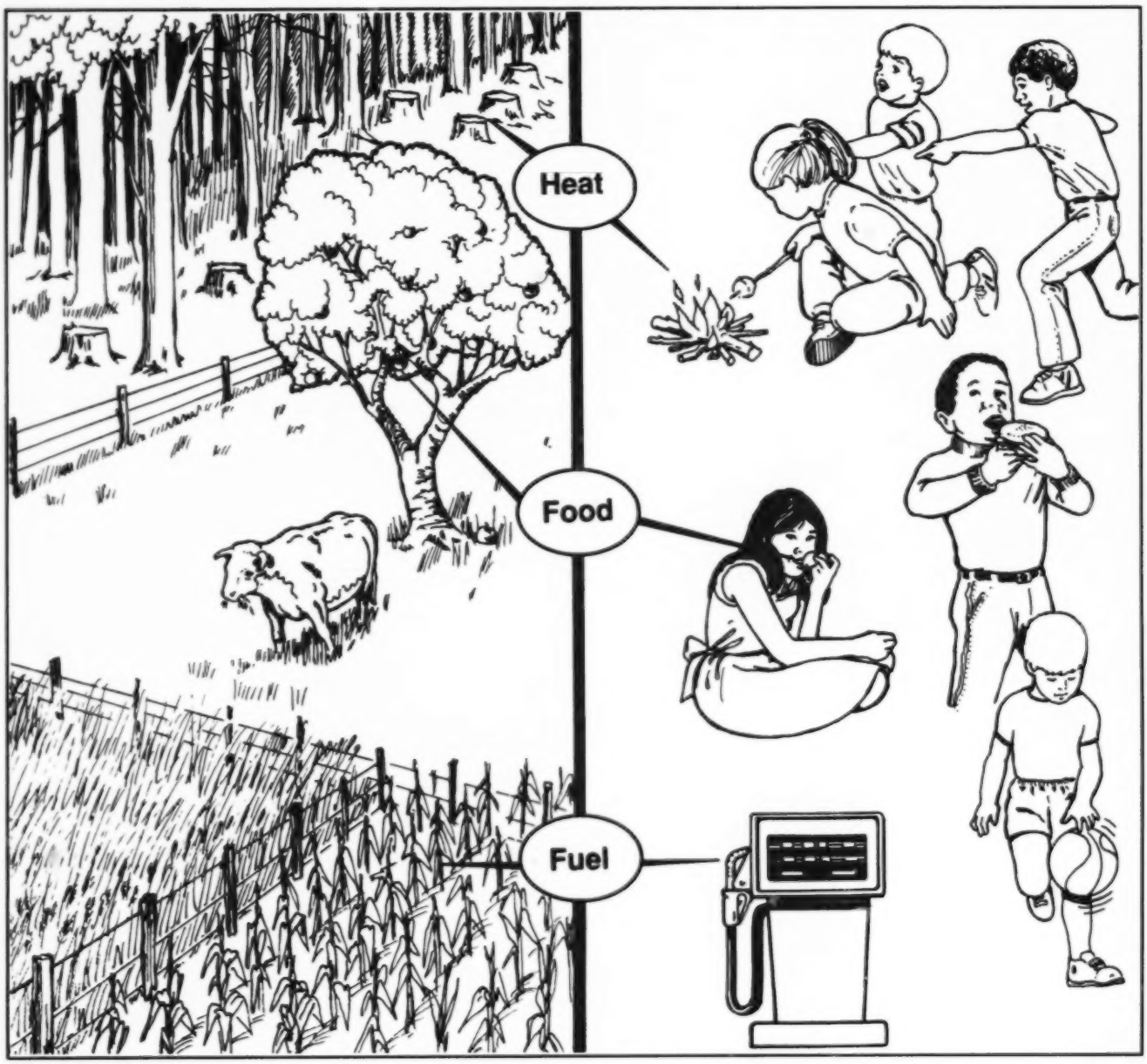
Energy from Plants



Plant sources give → Energy → to energy users.

1. What are three plant sources of energy shown in the picture?

2. Explain how children have energy to play.
   (Where do the hamburger, bun, and apple come from?)

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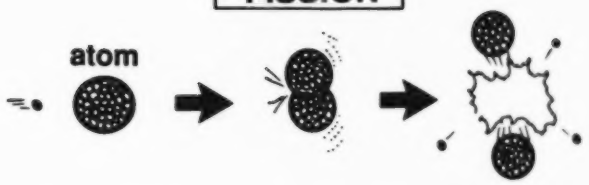
Nuclear Energy

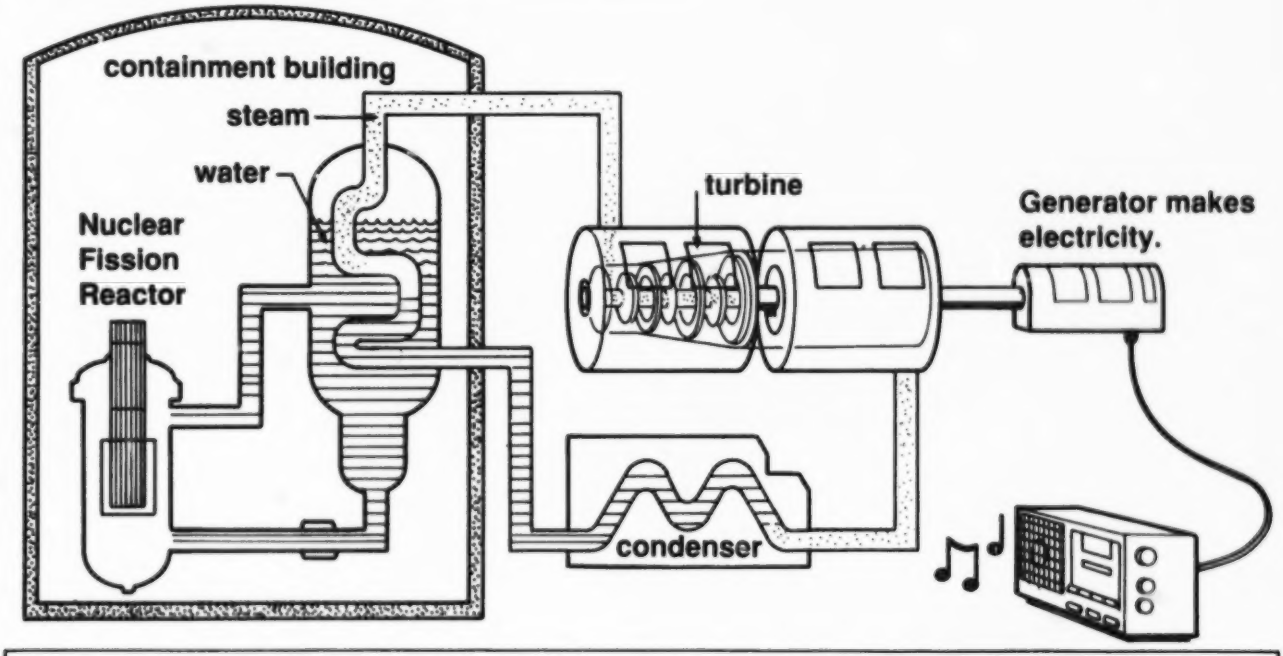
FISSION



Provides 1% of world's energy today.

Energy is released when the nucleus of an atom is split (called *fission*).

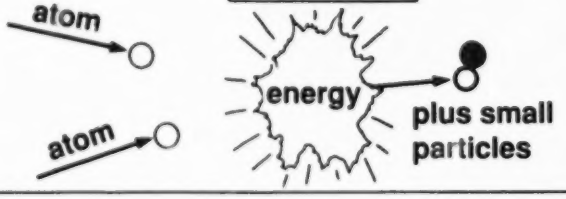
A NUCLEAR POWER PLANT AT WORK



Nuclear Power of the Future

Energy is released when the nuclei of two atoms join (called *fusion*).

FUSION



Q

1. What creates energy from fission?
2. What creates energy from fusion?
3. Heat released from atoms turns water into _____ that generates electricity.

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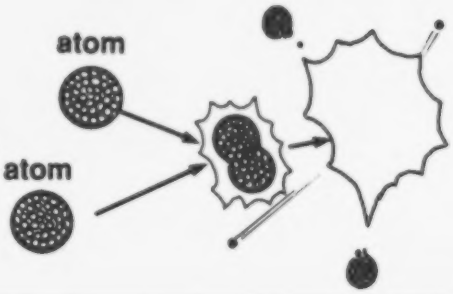
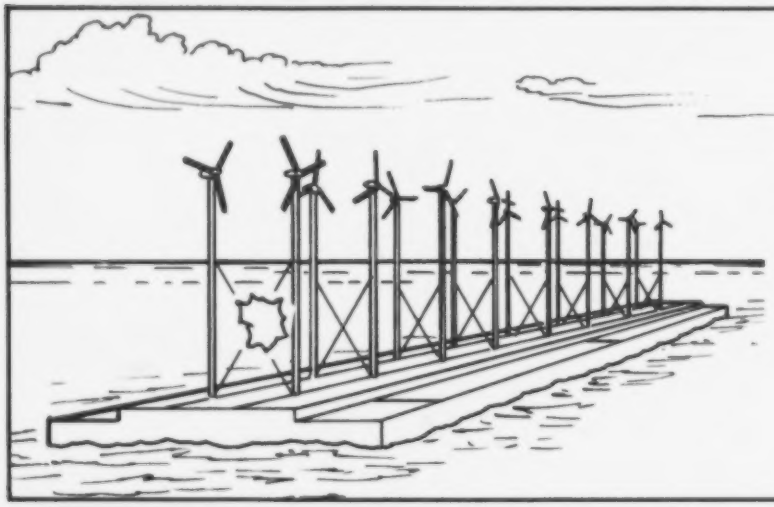
What Will Be Our Energy of the Future?

Nuclear Fusion

Combining heavy hydrogen atoms (available from the oceans) gives off enormous energy.



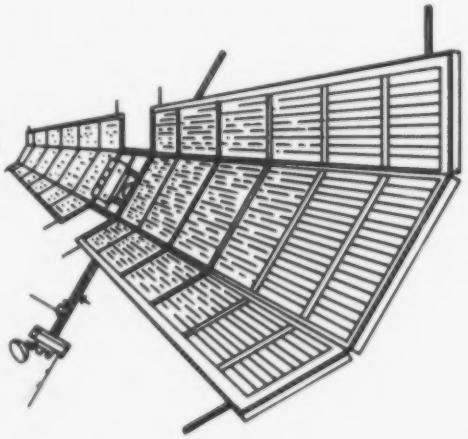


Windmills on the Water

Windmills on floating islands can be positioned to catch the prevailing ocean winds to generate electricity.

Orbitting Solar Collectors

Solar energy, captured by giant solar panels, can be sent to earth and changed to electricity.



Q

1. Is there a *limited* or *unlimited* supply of these forms of energy?
2. Fossil fuels (coal, oil, natural gas) pollute the air. Would the forms of energy above cause pollution?
3. Stretch your imagination: make up your own future energy idea.

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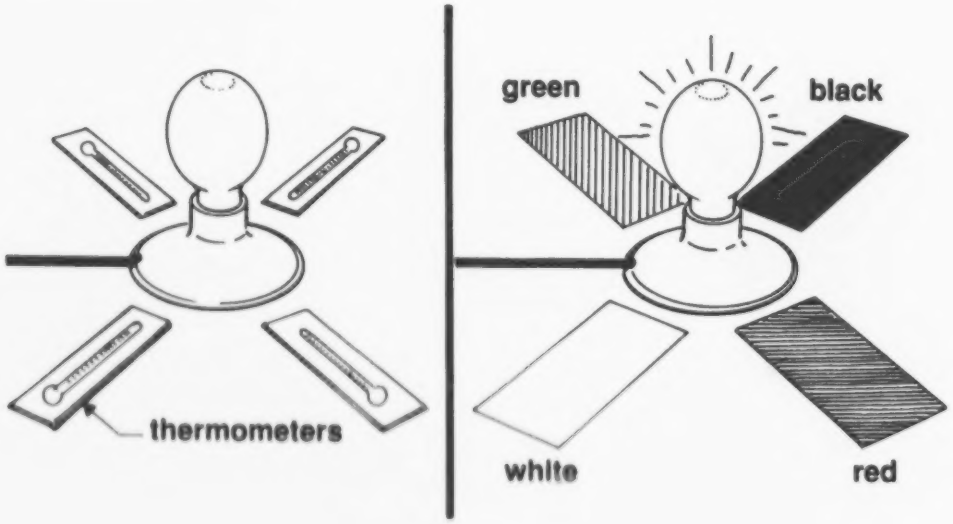
Hot and Cold Colors

Some colors *reflect* heat energy. Some colors *absorb* heat energy.

Questions: Which colors do you think reflect heat energy?
Which colors do you think absorb heat energy?

Materials: 4 pieces of construction paper (white, black, green, red) large enough to cover a thermometer; 4 thermometers; lamp with 60 watt light bulb (source of heat energy)

Procedure:
1. Place the thermometers so they are all the same distance from the light bulb (approximately 5 cm).
2. Record the starting temperature of each thermometer.
3. Place a piece of construction paper on top of each thermometer. Then turn on the light. Wait 15 minutes.
4. Record the temperatures for each color.



Results:
1. Make a graph of the findings.
2. What did you learn about the different colors and their temperatures? _____

_____

Conclusions:
1. What colors reflect heat energy? _____
2. What colors absorb heat energy? _____
3. Which color is the best for a roof to keep a house warm in winter? _____
4. Which color is best to wear to keep cool in summer? _____

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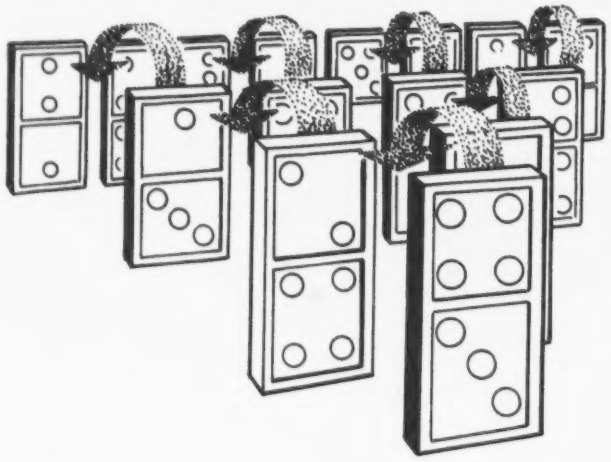
Nuclear Chain Reaction

Question: How does nuclear fission create so much energy?

Materials: box of dominoes

Procedure: Set up one domino. Place two dominoes behind it, so they will be knocked over when the first falls on them. Place four dominoes behind the two, so they will fall when the two in front fall against them. Place eight dominoes behind the four.

Predict what you think will happen: What happens when you tip the lead domino?



Each domino represents a uranium atom. When it falls (splits), it releases energy. A chain reaction continues and the total energy released is enormous.

Results:

1. What happened when you tipped the first domino?_____

   _____

2. How many dominoes (atoms) would be in the fifth line?_____

Conclusion:

Why do you think nuclear fission creates so much energy?_____

_____

_____

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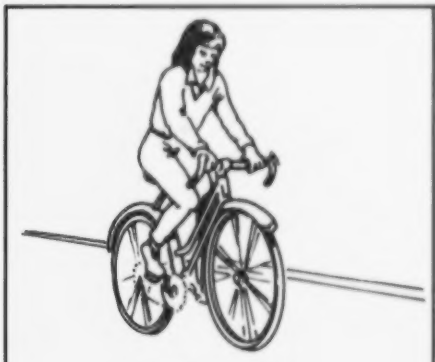
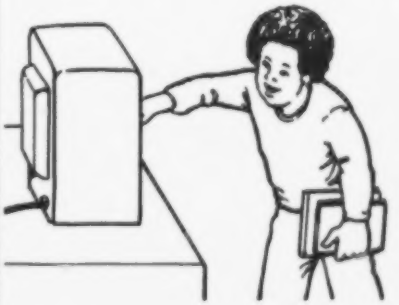
Do You Have a Home Energy Plan?

We need to save energy (resources and money, too). Put a check by those energy-savers you use.



____ bike or walk
____ keep car tuned
____ car pool

____ turn off lights when not needed



____ turn off TV and radio when not in use

____ recycle plastic
____ recycle cans
____ recycle paper
____ recycle glass

____ plant leaf-trees to shade south side during summer
____ plant evergreens to block wind during winter

____ turn down thermostat in winter (wear a sweater)
____ close drapes or shades to keep cold or heat out

____ wash only full loads in clothes washer
____ wash only full loads in dishwasher

____ use solar dryer

Draw your energy-saving idea here.

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Review Quiz

A. Circle the correct answer.

1. Sunny climates are necessary for geothermal power. T F
2. Windmills can only be used to pump water. T F
3. Falling water can be used to produce electricity. T F
4. An energy source for the future will be nuclear fusion. T F
5. Turbines are part of hydroelectric power plants. T F

B. Match the letters in column B with the phrases in column A.

A	B
_____ 1. uses solar energy	a. food
_____ 2. source of geothermal energy	b. calculator
_____ 3. gives energy for work and play	c. fission
_____ 4. releases energy from atom	d. coal
_____ 5. type of fossil fuel	e. magma

C. Circle the correct answer.

1. Geothermal power is used to produce electricity in _____ .

   Minnesota California Florida

2. One environmental problem caused by the need for energy is _____ .

   crops magma smog

3. Nuclear energy is released from _____ .

   atoms oil water

4. _____ is one source of energy we get from plants.

   Geothermal Nuclear Heat

5. Energy from _____ can cause air pollution.

   fossil fuels solar cells falling water

D. What can be done to stop environmental problems caused by our need for energy? _____

_____

_____

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Teaching Guide

Background Information for Visuals:

Sources of Energy

Sources of energy illustrated are wood, solar, wind, water, fossil fuels, geothermal, and nuclear. An energy source is any material that can cause a change in matter. Chemical changes take place when wood, coal, oil, and gas are burned. Energy is released as light and heat.

Fossil fuels and elements needed for nuclear energy are nonrenewable sources of energy. Wind, water, solar, and geothermal are renewable sources of energy. Although wood from trees is a renewable resource, it is being used faster than it can be replenished and is rapidly becoming a nonrenewable source of energy. Alternative sources of energy (wind, water, geothermal, nuclear, and solar) are not fossil fuels. Using alternative sources will help to increase our supply of energy resources for increasing demands.

For Discussion: *What are some ways we use these energy sources?* Possible answers: We use them to heat and light homes and other buildings, to cook food, to burn campfires, to operate machinery and appliances, to make electricity for TVs, radios, and other equipment, and so on.

Environmental Problems

Utilizing some energy resources creates environmental problems. More than two-thirds of the world's population in developing countries depend upon wood as their primary source of energy. Each year 28 million acres of tropical forest are cleared for crop production, fuel needs, and cattle ranching. We are clearing the forests so rapidly that they do not have time to regrow. Deforestation also contributes to the greenhouse effect because carbon from decaying and burning vegetation is released into the atmosphere.

Burning fossil fuels for energy also releases carbon and contributes to the greenhouse effect. The sulfur dioxide, nitrogen dioxide, and particulates emitted by the burning of fossil fuels create smog and acid rain. These two forms of pollution affect human health adversely and damage the environment, including wildlife resources, water supplies, and vegetation.

Although nuclear power may become a good alternative energy source in the future, presently it creates its own environmental hazards. The process of creating energy by atomic fission leaves behind potentially dangerous waste products. The world is discovering that there is currently no safe way to dispose of this nuclear waste. Before we depend too much on nuclear energy we will have to find environmentally safe methods of disposing of these radioactive toxins.

For Discussion: *Which energy sources in this home cause environmental problems?* Using energy from plants (firewood) depletes forests and releases carbon into the air, contributing to the greenhouse effect. Electricity (lamp, TV) produced from the burning of fossil fuels depletes limited coal resources and emits air pollutants. Using gasoline as an energy source (car, lawn mower) depletes limited oil resources and emits air pollutants.

Formation of Fossil Fuels

The Carboniferous period (Mississippian and Pennsylvanian) lasted from approximately 345 to 280 million years ago. During part of this period vast portions of the United States were covered with swampy lowlands. The plant life consisted of fast-growing forests of spore-bearing trees and ferns. As this luxuriant vegetation died, it sank into the water. Bacterial action was slow. The vegetation turned to a blackish, carbon-rich, woody gel. Later, other sediments covered the woody gel. The weight of these rock-forming sediments squeezed out water and gases from the black gel. Through time this material became bituminous coal, a sedimentary rock. Heat and pressure turned the soft bituminous coal into anthracite, hard coal. Minute animal and plant material buried under sediments in sea water in ancient times eventually became oil and gas. As with coal, when these minute organisms died, their remains settled to the bottom of the oceans and were eventually covered with heavy rock-forming sediments. Over millions of years natural forces turned the plant and animal substances into oil. Today fossil fuels supply approximately 90% of the energy needs of the world.

For Discussion: *Why must we use our fossil fuels very carefully?* Fossil fuels are nonrenewable resources and, once burned, they cannot be recycled or reused. *Why does the increased use of plastics contribute to the use of fossil fuels?* Oil is used in the production of plastics.

Production of Electricity

Approximately one-third of the United States' primary energy needs are met by electricity. Coal-burning plants produce most of the electricity. Coal is burned to heat water, turning the water into steam. The steam can be used to turn turbines which rotate generators, producing electricity. Oil, gas, or nuclear fuels are used in place of coal in some electric power plants. The second major producer of electric energy in the United States is the hydroelectric power plant. A dam, built in a narrow valley, holds back water stored behind it. The force of moving water released from the dam turns turbines which themselves turn generators. The generators produce electricity which is sent over power lines to factories, stores, and homes. Recently, solar energy has been used to produce a very limited amount of electrical energy. Semiconductor devices in photovoltaic cells (solar cells) produce voltage when illuminated. When light energy strikes the solar cell, electrons are knocked free producing a small voltage. Many cells in a solar panel can produce enough electricity for a home.

For Discussion: *Why would mountain areas be good places to build hydroelectric power plants?* It is easier to dam narrow mountain valleys and create reservoirs than it is to dam wide rivers in broad valleys. *What is an advantage of using solar power?* The sunlight is free and it is nonpolluting.

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Page 1 Solar Energy

Objective: Identify two ways of using solar energy.
Background Information: Solar energy is a safe, nonpolluting energy source with unlimited energy reserves. Two devices which use solar energy are the solar collector and the solar cell.

Solar collectors contain a black metal plate which absorbs sunlight. The plate is covered with a glass sheet which keeps heat from escaping. Heat warms the water in pipes fastened to the metal plate. The water is heated and stored in tanks. It can be used for heating the air in a building or for washing purposes. Solar collectors are placed on rooftops facing south to get the most direct sunlight. One limitation of the solar collector is that it can only warm water on sunny days. A backup heating system such as a furnace or wood-burning stove is needed during extended periods of cloudy weather.

Solar cells change solar energy directly into electricity. When sunlight hits a special material in the cell, electrons are knocked loose. The electrons flow into connecting wires, becoming a current of electricity. One drawback of the solar cell is that it is still costly and time-consuming to produce.
Directions: Use the background information provided to show students two devices that use solar energy.
Answers: 1. Solar energy is the heat and light that comes from the sun. 2. The solar collector and the solar cell use solar energy.
Extension Activities: 1. Research how solar cells have been used by the space program to provide energy for operating satellites. 2. Correlate with social studies to find areas in the world where solar energy is available nearly year round.

Page 2 Wind Energy

Objective: Identify past and present machines that use wind energy.
Background Information: During the 1920s and 1930s small windmills provided energy for millions of farms in the United States. Wind energy was transformed to mechanical energy by a set of gears. Wind machines today can convert mechanical energy to electrical energy with a generator. There are two types of wind machines: horizontal axis and vertical axis. The American farm windmill is a horizontal axis wind machine. The Darrieus wind turbine is a vertical axis wind machine. Developed in the 1920s, the Darrieus wind turbine looks like an enormous egg beater and is the most efficient vertical axis wind machine to date.

The mechanical energy generated by the traditional farm windmill was used to pump water for people and livestock, to grind grain, and to generate electricity for use on the farm. Wind energy has been developed for other uses such as irrigation of croplands, drying grain, and generating electricity to sell to public utilities. Wind farms in existence in New Hampshire, California, Hawaii, and Montana sell electricity to local utilities. One drawback to wind energy is the limited number of areas with a steady wind.
Directions: Use the background information provided to explain the wind machines used in the past and in the present.
Answers: 1. Wind energy was used on farms. 2. Wind machines today convert wind energy to electrical energy.
Extension Activities: 1. Research whether there is sufficient wind in your area to use windmills for electricity. 2. Correlate with social studies by researching the historical use of windmills in Holland.

Page 3 Geothermal Energy

Objective: Describe the source of geothermal energy.
Background Information: Geothermal energy results from heat generated within the earth's surface by the radioactive decay of rocks or from hot, molten magma. When magma appears close to the earth's surface, it heats the layer of rock directly below groundwater sources. The water becomes heated and releases steam at the earth's surface where it can be used to make electricity. In a geothermal power plant, steam from heated ground water rushes through wells to turbines. These turbines run generators that produce electricity.

One limitation of geothermal energy is the small number of resource areas with high temperature reservoirs. In the United States, these areas are found most often in the West. Geothermal electric power plants are operating in California, and facilities that use the heated water directly are operating in several Western states.
Directions: Use the background information provided to explain the source of geothermal energy.
Answers: 1. Magma or radioactive decay within the earth's surface provides heat for geothermal energy. 2. Water is heated underground and brought to the surface through wells at the power plant.
Extension Activities: 1. Research the use of geothermal energy in Reykjavik, Iceland. 2. Correlate with geography by locating on a physical map these areas with hot springs or steam close to the surface of the earth: The Geysers, California; Boise, Idaho; Roosevelt Hot Springs, Utah; and Valles Caldera, New Mexico; North Island, New Zealand (also areas of Mexico, Italy, and Japan).

Page 4 Energy from Water

Objective: Explain how falling water is used to produce electric energy.
Background Information: Where there is a suitable waterfall or river that can be dammed, a hydroelectric power plant (hydro means water) can be built. Water, running through pipes, falls from a high to a low level. The energy from the falling water turns blades in a turbine that turns the magnet in a generator to produce electricity. Hydro power is free and renewable; it does not cause pollution and does not have to be mined or pumped from the ground. Some of the water stored behind a dam can be used for crop irrigation or water supplies for nearby communities.

Use of hydroelectric power plants is limited since there are few suitable location sites, most of which have already been developed. Proximity to cities, cost of construction and maintenance, loss of recreation sites, build-up of mud behind the dam, and environmental impact on the dammed area are some important factors in the decision to construct a hydroelectric plant.

Another source of water energy is the ocean's tides. The difference between water levels at high tide and low tide can be as much as five meters or more. An efficient place to build tidal power plants is along the seacoast where the tide flows through narrow inlets. At high tide, water flows through the dam gates and is trapped behind the dam. At low tide the gates are opened and the water falls down the pipes and turns turbine blades.
Directions: Use the background information to explain hydroelectric energy. Mention the pros and cons of using water resources.
Answers: Answers may vary depending on where your community is located. 1. If your community is located in an area where a hydro-

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electric dam is possible, then it is a good source of energy because it is free, renewable, it does not cause pollution, and it does not have to be mined or pumped from the ground. 2. Most hydroelectric power plants are located on large rivers.

Extension Activities: 1. Research the source of your community's electrical energy supply by contacting your local electric company. Find out if hydroelectric power is used. 2. Correlate with language arts by having student(s) explain to the class how water wheels work to help produce energy. Small models might aid in the presentation.

Page 5 Energy from Fossil Fuels

Objective: Recognize that fossil fuels are nonrenewable resources and that we are depleting our supply of them.

Background Information: The fossil fuels (coal, oil, and natural gas) are our main energy resources. Consult the fossil fuel visual and accompanying text for an explanation of how they were formed.

When coal, oil, and natural gas are burned, the energy in them is released. As coal is burned the energy heats water, changing it to steam that powers machines that generate electricity. Oil is pumped to a refinery where it is separated into fuels (one of which is gasoline) and other substances. As the fuels are burned, energy is released to power vehicles. Natural gas is piped to storage tanks and distribution centers and then piped to homes and other buildings. As the gas is burned the heat energy heats homes and other buildings.

Fossil fuels are nonrenewable resources; they cannot be replaced. Additionally, the heavy use of fossil fuels, especially coal and oil, creates many environmental problems such as air pollution, acid rain, strip-mining, and oil spills. For these reasons, we need to conserve our use of coal, oil, and natural gas. Limiting our use will affect the way we live and will change many of our habits.

Directions: Before students do this page, use the fossil fuel visual in explaining how coal, oil, and natural gas were formed. Discuss the methods by which heat energy from the fossil fuels is used in the pictures. Then have students draw pictures in the boxes to complete each statement. Next have students suggest ways in which they could help conserve the fossil fuels, nonrenewable resources. Conclude the lesson by mentioning the environmental problems caused by the use of fossil fuels.

Answers: 1. Possible answers for ways individuals can limit use of fossil fuels are: turn lights off when not in use; dry clothes on a line when the weather temperature permits; put covers on pots when cooking; have furnace regularly checked, cleaned, and in proper working order; add storm windows or clear plastic to windows; caulk leaky windows and doors; cover windows with drapes and shades at night; take the bus, car pool, ride a bike, and walk more; keep the car well tuned. 2. Answers may vary but can include switching to alternative fuels.

Extension Activities: 1. Research two new energy resources scientists are developing—coal gas and oil shale. 2. Correlate with social studies by making a list of ways in which people today use energy that people in the 1700s did not.

Page 6 Energy from Plants

Objective: Identify plants as sources of energy.

Background Information: We get most of our energy from plants: energy for food in the form of grains, vegetables, nuts, and fruit; energy for fuel from wood. Wood is a cheap, available source of heat for homes and cooking.

A wise conservation practice is to replace forests as fast as they are cut down for fuel, but in many areas of the world, this is not being done. It has been suggested that crops such as sugarcane, pineapple, corn, soybeans, peanuts, or sunflowers be grown for the energy content in their sugars, stalks, or oils. When corn is cooked and fermented, a watery solution of ethyl alcohol (ethanol) results. Ten percent distilled ethanol mixed with ninety percent gasoline produces a motor fuel called gasohol. At this time, the production of gasohol is not as efficient or economical as the production of gasoline.

As use of wood for fires in homes increases, the amount of smoke in the air increases. The air pollution levels in those areas rise as a result. Also, as the demand for wood fuel rises, the price of wood rises. In some areas, wood is becoming more expensive.

Directions: Help students interpret the picture concept. Plant sources give energy to plant users. Have students relate their own experiences to personalize the concept.

Answers: 1. Trees produce heat; apples produce food; corn produces fuel. 2. The children are eating apples (a plant), hamburger buns which are made from wheat (a plant), and hamburgers which come from a cow that ate grass (a plant).

Extension Activities: 1. Research how charcoal is made. 2. Correlate with health lessons. Food from plants gives us energy to do things. Which foods give us the most energy? For what reasons do we need to eat grains, nuts, fruits, and vegetables?

Page 7 Nuclear Energy

Objective: Learn the types and power of nuclear energy and how people turn it into electricity.

Background Information: Nuclear energy, which supplies 1% of the world's energy needs, captures the power of the atom. Enormous energy is released by splitting the atom's nucleus (fission) or by joining two atoms' nuclei (fusion).

In a nuclear fission reactor, the nuclei of radioactive fuel, such as uranium, are split. Great amounts of heat are released and a chain reaction continues, splitting more uranium nuclei and releasing more heat. Control rods and water control the chain reactions and the amount of energy released. The heat from the splitting atoms is used to turn water into steam. The steam drives a turbine that turns electric generators. Fast breeder reactors are being developed that will create more fuel than they consume.

People are attempting to master atomic fusion (the energy of stars) by joining atoms of heavy hydrogen, which are available from ocean water in limitless supplies, to produce energy with less radioactive danger than occurs in fission. Very high temperatures are needed to fuse the atoms, but only small amounts of fuel are needed to produce a great amount of nuclear energy. Fusion does not present the pollution problems of fossil fuels.

Nuclear power as a source of electricity seems to be an ideal alternative. However, we must guard against radioactivity from nuclear plants and achieve safe disposal of hazardous nuclear waste. Additionally, we must make sure that water from the reactor is cooled before it is dumped into rivers and streams. Dumping heated water into waterways is a form of water pollution that kills fish and other aquatic life.

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Directions: Use the worksheet to introduce the concepts of fission and fusion and how these processes produce nuclear energy.
Answers: 1. The splitting of an atom creates the energy in fission. 2. The joining of the nuclei of two atoms creates the energy in fusion. 3. steam
Extension Activities: 1. Gain a better understanding of fusion by researching how our sun and the stars produce their own light and heat. 2. Correlate with geography by locating on a map France, Finland, and Belgium—countries that satisfy a large amount of their energy needs with nuclear power.

Page 8 What Will Be Our Energy of the Future?

Objective: Promote creative thinking by familiarizing students with possible energy sources of the future.
Background Information: Of the many possible energies of the future, three may inspire young minds most. The first of these is **nuclear fusion.** Ultimate energy sources may be safe fusion, the nuclear reaction that provides heat and light for our sun and stars. Heavy hydrogen atoms taken from ocean water can provide all the fuel ever needed. By the year 2000, people may be able to produce temperatures high enough to cause atoms' nuclei to fuse into a massive doughnut-shaped magnet.

The second possible energy of the future is **solar collectors.** Giant solar panels could be set in orbit 22,300 miles above earth, collecting sunlight's energy 99% of the day (only eclipses would darken the panels). Electric energy would be converted into microwaves and beamed by radar transmitters to earth-antennae, and reconverted into usable electricity.

The third possible energy of the future is **windmills on water.** People have harnessed and used the wind for years. We know where the prevailing winds are and how they shift in direction and speed. Artificial islands of windmills can sail into the winds; the turning windmill blades can generate electricity.
Directions: Use the background information on this worksheet to stimulate discussion of possible sources of energy in the future.
Answers: 1. unlimited 2. no 3. Answers will vary.
Extension Activities: 1. Research the history of windmills. 2. Correlate with library skills by looking up the latest research on fusion.

Page 9 Hot and Cold Colors

Directions: Review the concepts of reflection and absorption. Assist students as needed in completing the activity. Some direction might be helpful in designing the graphs and recording the temperature readings.
Answers: Light colors reflect it. Dark colors absorb heat energy.
Results: 1. graph 2. The black and red papers showed a greater temperature increase than the white and green papers.
Conclusions: 1. White and green reflect heat energy. 2. Black and red absorb heat energy. 3. A black roof is best for winter. 4. White is a good color to wear in the summer.

As a result of students' findings, discuss choices of garment color the students wear in relation to keeping warm in winter and cool in summer. What color is the school's roof? the roofs of houses in the neighborhood? Are the colors of these roofs wise or poor choices? Expand the discussion to include color of automobiles in relation to heating and air conditioning.

Students may wish to try other colors in the experiment to see if they absorb or reflect heat energy.

Page 10 Nuclear Chain Reaction

Answer: Nuclear fission creates so much energy because it releases twice as much energy at each progressive step.
Prediction: The first domino will knock over the two dominoes behind it. This action will continue until all dominoes (uranium atoms) are knocked down.
Results: 1. A chain reaction continued until all dominoes (uranium atoms) were knocked down. 2. sixteen
Conclusion: At each step of a chain reaction twice as much energy is released as was released in the step before.

Page 11 Do You Have a Home Energy Plan?

Directions: Encourage students to go over this checklist with parents at home and to plan on using as many of the energy savers as possible. Ask students to share their own energy saving ideas with the class. (An example might be placing rugs at the bases of doors in winter to keep the wind out.)
Extension Activities: Find the names of the congress people in your area. (You have two state senators and one or more representatives to the United States Congress in addition to representatives to your state's governing body.) Write a letter to these politicians expressing concern for the environment. State the reasons for your concern. If you can, offer suggestions for environmental problems. Even if you cannot offer suggestions, simply letting government officials know of your concern will help bring about solutions to environmental pollution. You can send each politician the same letter if you make several copies, changing only the name and address on each. See if your congress people to the U.S. or to your state respond.

Page 12 Review Quiz

A. 1. F 2. F 3. T 4. T 5. T
B. 1. b 2. e 3. a 4. c 5. d
C. 1. California 2. smog 3. atoms 4. Heat 5. fossil fuels
D. We need to stop using fossil fuels that pollute and deplete natural resources. We should use nonpolluting sources of energy such as solar, geothermal, or hydroelectric energy.

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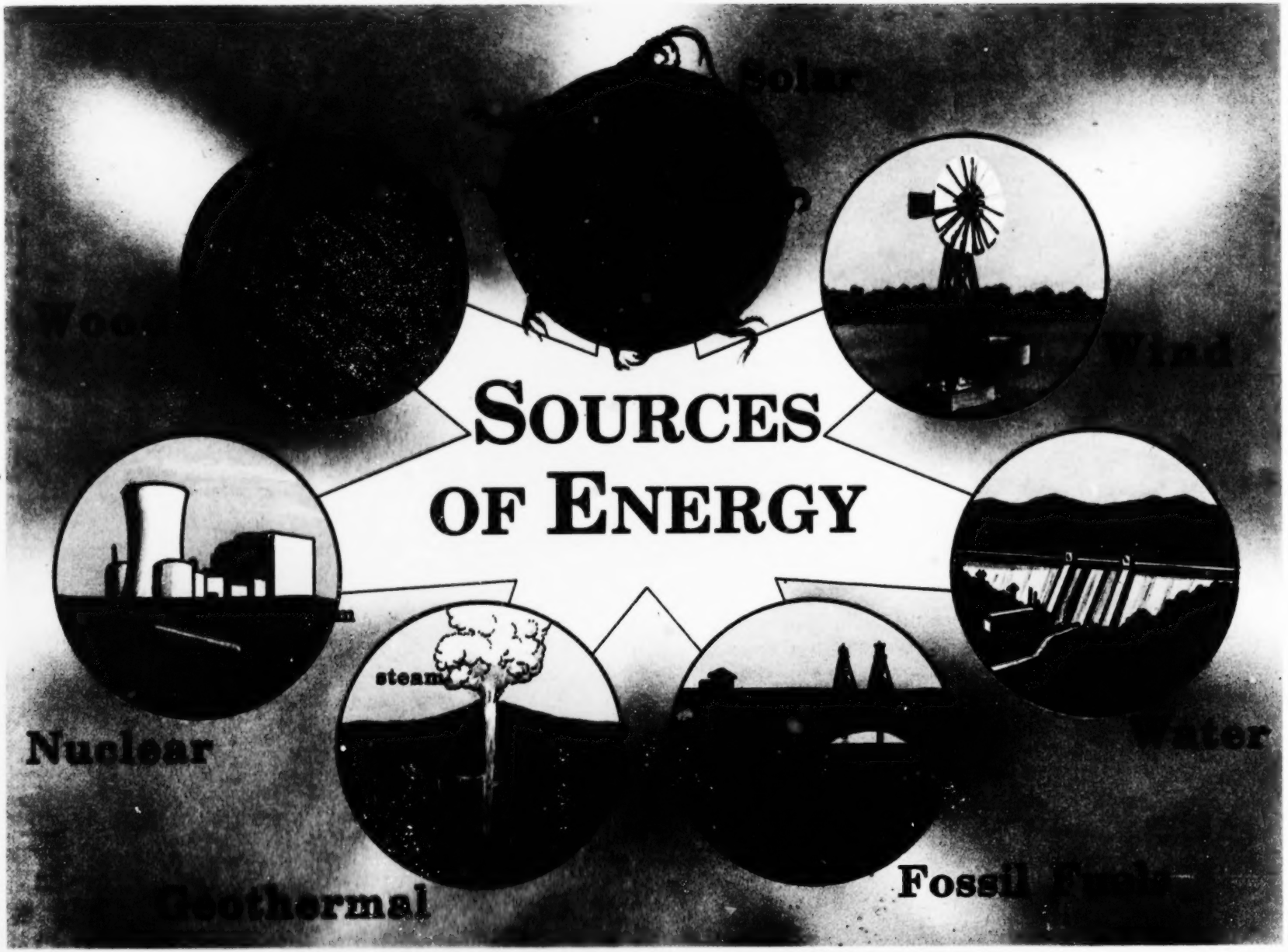

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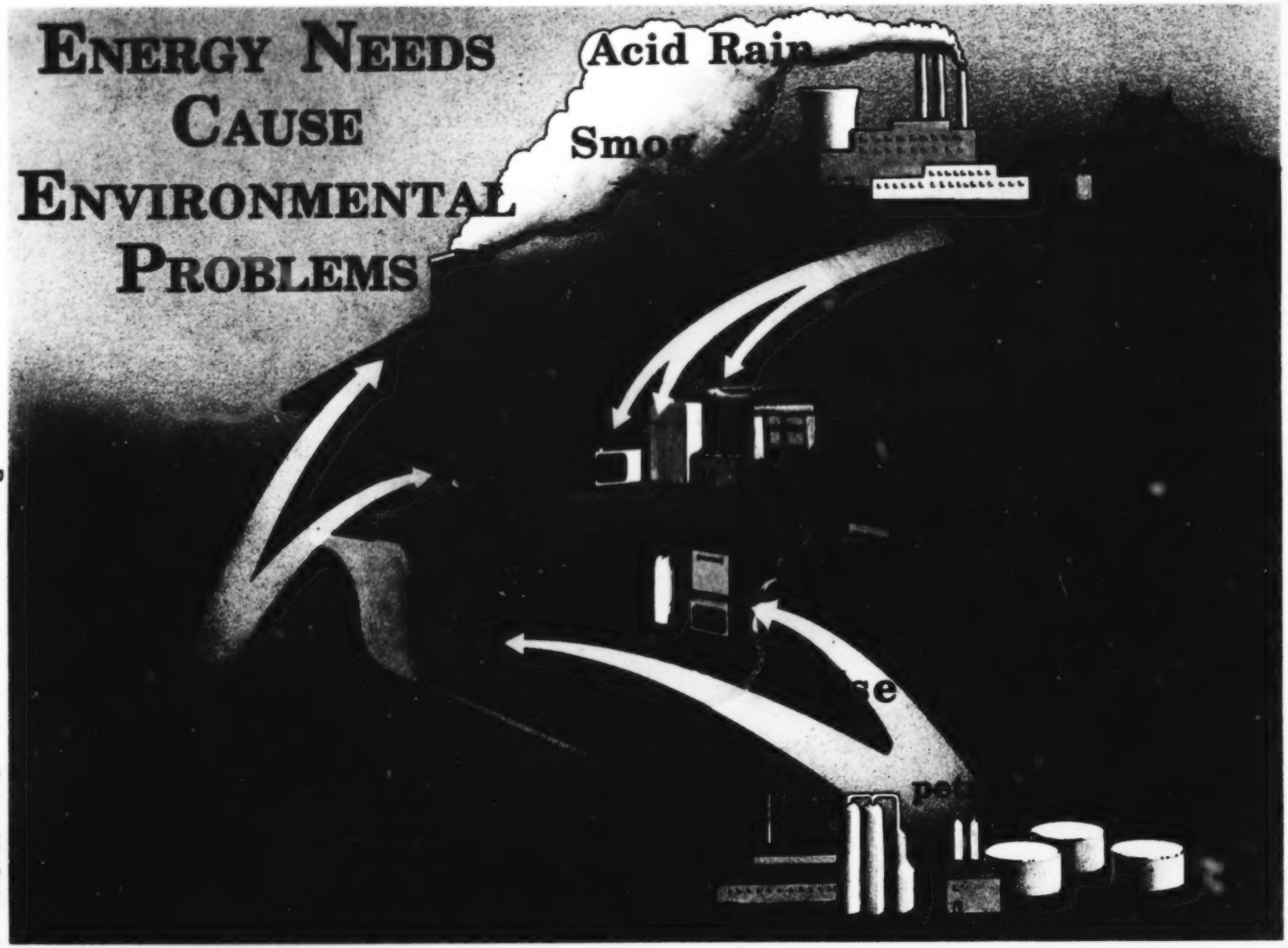

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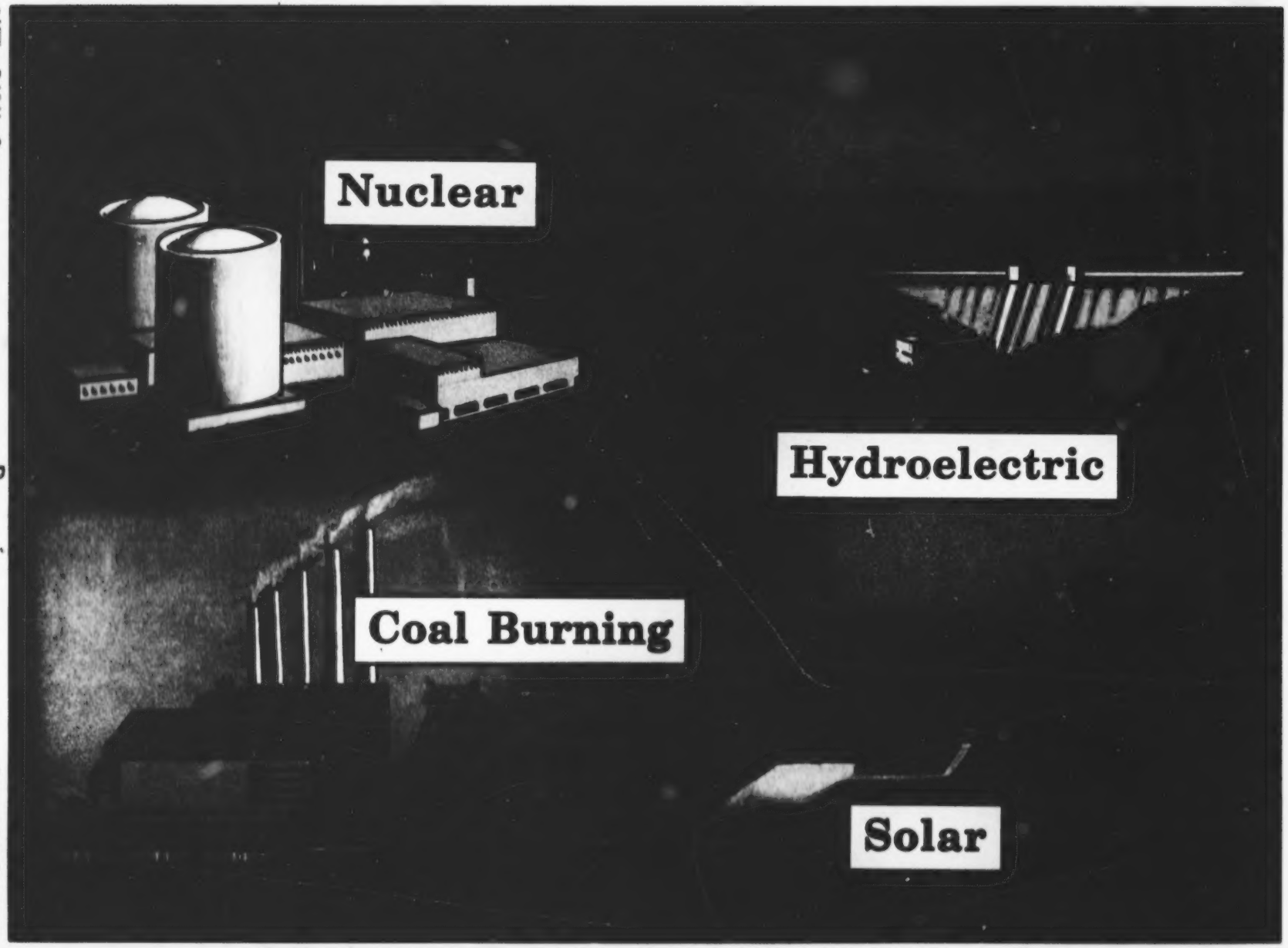

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